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EXPERIMENTS ON SEX IN MUSHROOMS AND TOADSTOOLS

MISS MOUNCE,¹ working under my direction, found that *Coprinus sterquilinus*, *C. stercorarius* (a sclerotium-producing species), and *C. narcoticus* are all homothallic. All the spores in each of these species are sexually of one kind, and each spore gives rise to a mycelium which becomes diploid and fruits perfectly without fusion with any other mycelium.

Hans Kniep² has shown that in *Schizophyllum commune* and *Aleurodiscus polygonius*, segregation in the basidium results in the production of four sexually different haploid genotypes, so that the spores sexually are of four different kinds. Normally one kind can react with only one of the others. Two Mendelian pairs of factors are involved. The diploid fusion nucleus in the basidium bears both pairs of factors and may be represented as (AaBb). The haploid nucleus of each of the four spores bears only one of each pair of factors, so that sexually the four kinds of spores may be represented as (AB), (Ab), (aB), and (ab).

W. F. Hanna,³ working in my laboratory upon *Coprinus lagopus*, has confirmed Kniep's results. His experiments, which have involved some 1500 matings, clearly demonstrate that, here again, we have a species which bears spores which sexually are of four different kinds: (AB), (Ab), (aB), and (ab).

There has just come into my hands a paper by Vandendries,⁴ in which he records experiments which prove that *Coprinus radians* is bisexual, i.e. that this fungus produces spores which fall into two sexually opposite groups, and not into four groups as found by Kniep for *Schizophyllum commune* and *Aleurodiscus polygonius* and by Hanna for *Coprinus lagopus*.

¹ Irene Mounce: (1) "Homothallism and the production of fruit-bodies by monosporous mycelia in the genus *Coprinus*," Trans. Brit. Mycolog. Soc., viii., 1921, pp. 198-217. Also (2) "Homothallism and heterothallism in the genus *Coprinus*," *ibid.* 1922, pp. 256-269. An account of the experiments made with *Coprinus narcoticus* has not yet been published.

² Hans Kniep: (1) "Über morphologische und physiologische Geschlechtsdifferenzierung," *Verhandl. der physikal.-med. Gesellschaft zu Würzburg*, xlv., 1919; (2) "Über Geschlechtsbestimmung und Reduktionsteilung," *ibid.* xlvii., 1922; (3) "Über erbliche Änderungen von Geschlechtstactoren bei Pilzen," *Zeitsch. Indukt. Abstamm. u. Vererb.*, xxx., 1923.

³ W. F. Hanna, "The Problem of Sex in *Coprinus lagopus*." To appear shortly in the *Annals of Botany*.

⁴ R. Vandendries, "Contribution nouvelle à l'étude de la sexualité des Basidiomycètes," *La Cellule*, xxxv., 1924.

Miss Dorothy Newton,⁵ who has been studying the problem of sex in my laboratory for upwards of a year, has obtained results with *Coprinus Rostrupianus* which are exactly similar to those Vandendries obtained with *C. radians*; for, as a result of upwards of 400 matings, she has found that in *C. Rostrupianus* the spores fall into only two groups which are sexually opposite.

In *Aleurodiscus polygonius*, under certain abnormal moisture conditions, the four spores of each basidium are shot away together in a single mass. Kniep⁶ noted this fact and took advantage of it to analyse the sexual reactions of the four spores on each of thirty-five basidia. He found that each basidium bore two kinds of spores, two of one sex and two of another, and that there were two kinds of basidia, so that the two pairs of spores of one group of basidia were different sexually to the two pairs of spores of the other group of basidia. The four spores of one group may be represented as (AB), (AB), (ab) and (ab), and the four spores of the other group as (Ab), (Ab), (aB) and (aB).

Kniep's method of obtaining the four spores of a single basidium and separating them by shaking them apart in agar is applicable, so far as is at present known, only to *Aleurodiscus polygonius*; and Vandendries was unable to analyse the sexual reactions of the four spores of a single basidium of his *Coprinus radians*.

A method for removing the four spores of a single basidium and sowing them separately has been devised in my laboratory, and it has the advantage over the method used by Kniep in that it is not dependent on an abnormality but is generally applicable to normal fruit-bodies of Coprini and other Hymenomycetes.⁷ The method is as follows. A gill is placed on a slide and a cover-glass is lowered down upon it and pressed gently against the hymenium. The cover-glass is then raised, inverted, and examined under the microscope. The four spores of each of a number of basidia are then seen to be attached by their apices to the cover-glass, so as to form tetrads resembling those which may be observed on isolated basidia when one looks down on a gill from above with the microscope. Using the dry-needle method,

⁵ D. Newton, paper shortly to be sent to the press.

⁶ Hans Kniep, "Über Geschlechtsbestimmung und Reduktionsteilung," *Verhand. physikal.-med. Gesellschaft zu Würzburg*, xlvii., 1922, pp. 1-29.

⁷ The method is described in Hanna's paper on *Coprinus lagopus*. It was devised and perfected by Miss Dorothy Newton, W. F. Hanna, and the writer, working conjointly.

described by Hanna,⁸ it is then not difficult to remove the other spores around a perfect tetrad and afterwards to pick up the four spores of the tetrad one by one and sow them individually in hanging drops of a culture medium.

By employing the methods just described, both Hanna and Miss Newton have successfully analysed the sexual reactions of the four spores of a considerable number of individual basidia. In Hanna's quadrisexual species, *Coprinus lagopus*, some of the basidia were found to bear spores of two kinds only, a pair of one sex and a pair of another and opposite sex, while other basidia were found to bear spores of all four kinds: (AB), (Ab), (aB), and (ab). The occurrence of four different kinds of spores on a single basidium proves that the reduction process in the basidium takes place with the second division of the nucleus, and not with the first as found by Kniep in the case of *Aleurodiscus polygonius*. In Miss Newton's bi-sexual species, *Coprinus Rostrupianus*, all the basidia have been found to be exactly alike, for they all bear only two kinds of spores, two of one sex and two of the other and opposite sex.

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⁸ W. F. Hanna, "The Dry-Needle method of making monosporous cultures of Hymenomycetes and other fungi," *Annals of Botany*, xxxviii., October 1924

